

from seeking society, but he enjoyed it when it came in his way, was a good listener, observant, and with a keen sense for the humorous side of things. He was very accessible, and ever ready to lend aid from the stores of his knowledge, but in particular did he delight to instruct and bring forward his younger friends.

I am happy to close this notice by speaking of the deep religious faith of this dear friend. Before reaching manhood, he consecrated his life to the service of God, through Christ, and never afterwards wavered in his trust. His belief was to him a source of perennial joy, and he did not fail in the duty of trying to bring others to share in the faith which was the life of his life. No stress of labor, no ordinary worldly interests, checked the spiritual meditations of this earnest man. Since his death there have come to light, before kept secret from his own family, volumes covering a period of nearly fifty years, embodying mainly his religious thoughts, and laying bare his soul. I confess that it is with a certain awe that I have read these utterances, voiced as it were from the grave. Here the whole man is seen, and the completeness of his character made clear.

Mr. DuBois was able to fulfill his official duties until within a few months of his death. He was fully conscious of his approaching end, preserving his intelligence to the last, and the faith which had comforted him in this life supported him at its close. He left surviving him a widow, two sons, and one daughter, who have in the memory of his well-spent life a blessed inheritance.

Note on the Laramie Group in the vicinity of Raton, New Mexico. By John J. Stevenson, Professor of Geology in the University of the City of New York.

(Read before the American Philosophical Society, December 2, 1881.)

Raton, New Mexico, is an important station on the Atchison, Topeka and Santa Fé Railroad, at about five miles south from the Colorado line. It stands on the Canadian plain immediately south from the basalt-capped Raton plateau (the Chicorica mesa of Hayden's map of Colorado), and at the foot of the Laramie bluff, which forms the western boundary of the plain. The cañon of Willow creek, followed by the railroad from the Colorado line, opens at little more than a mile north from Raton. Dillon's cañon and that of the Upper Canadian open together at barely two miles south-west from the station, while petty cañons notch the face of the bluff at irregular intervals.

The lower beds of the Laramie group are fairly well shown at many places along the bluff as well as near the mouths of the larger cañons. During 1881, the Atchison, Topeka and Santa Fé Railroad Company made extensive examinations of the *Dillon coal bed*, *coal bed A* of the writer's generalized section, which exhibit the structure of the bed far better than

did the natural exposures described in the writer's report on his explorations of 1878.* The measurements made at the company's openings are given here as supplementing the observations detailed in that volume.

The *Dillon* is the lowest persistent *coal bed* found in the Trinidad coal-field, and is separated from the *Haldymenites sandstone*, by but five to ten feet of shale. An opening on Coal cañon, tributary to that of the Upper Canadian, shows the following section :

1. <i>Coal</i>	0' 3'' to 8''	} 5' 1''
2. <i>Shale</i>	3' to 4' 0''	
3. <i>Coal</i>	0' 8''	
4. <i>Shale</i>	0' 1''	
5. <i>Coal</i>	0' 6''	
6. <i>Shale</i>	0' 1''	
7. <i>Coal</i>	0' 7½''	
8. <i>Coal</i> and sandy clay.....	0' 4½''	
9. <i>Coal</i>	0' 6''	
10. <i>Shale</i>	0' ¼'' to 4''	
11. <i>Coal</i>	1' 3''	
12. <i>Shale</i>	0' 1'' to 4''	
13. <i>Coal</i>	0' 10''	
14. <i>Bony coal</i>	0' 4''	

No. 3 sometimes falls to 4 inches. Like No. 5, it contains some good coal, but with it is not a little bony stuff, and the whole is strongly pyritous. Nos. 4, 6 and 12 are hard pyritous clays. Nos. 8 and 10 are sandy, sometimes becoming hard sandstone. Nos. 7 and 9 are fairly good coal, but contain binders and diagonal streaks of sandstone, which make them utterly worthless. Nos. 11 and 14 are bony stuff, but No. 13 is excellent coal.

This opening is evidently on the upper division of the bed. The lower division is not exposed. Another opening was run in the Canadian cañon, where entries had been driven in both divisions of the bed. The lower division has five benches, all of which yield coal with much ash. No new features were seen in the upper division. The clay overlying the bed here is full of leaf impressions.

A section was obtained in Dillon's cañon at a deserted opening, just below Dillon's ranch. This is described in the writer's report† upon this region, but the measurements are repeated here to show the general structure of the bed. The section is :

Upper division.....	4' 4''
Carbonaceous shale.....	0' 4''
<i>Coal</i>	2' 10''
<i>Shale</i>	0' 4''
<i>Coal</i>	0' 10''

* U. S. Geographical Survey, west of the 100th Meridian, Vol. iii. Supplement. Now passing through the press.

† Loc. cit. p. 275.

Clay shale, drab		2' 8''
Lower division		4' 7''
Coal.....	0' 10''	
Parting.....	—	
Coal.....	0' 8''	
Parting.....	—	
Coal.....	1' 7''	
Clay.....	1' 0''	
Coal.....	0' 6''	

The outcrop coal is not altogether promising in appearance, and has a decidedly slaty structure. Some of it was tried on a locomotive, but it burned much like rotten wood. Prospecting entries were driven into the sound coal at a little way below the old opening. The quality improved rapidly as the entries advanced, and a locomotive test of the sound coal proved as satisfactory as that of the crop coal had proved unsatisfactory. Extensive mining operations were begun here in June of 1881.

Many prospecting pits were digged north from Dillon's cañon along the bluff fronting on the plain, but none of these reached sound coal.

Fulbrite & Company made an opening in the *Dillon coal bed*, at, say, a mile and a half north-west from Raton. They mined only the upper division, which has the following structure :

1. Coal.....	0' 11 "	} 4' 1½''
2. Sandstone.....	0' 0¼ "	
3. Coal.....	1' 1 "	
4. Parting.....	0' 0¼ "	
5. Coal.....	0' 8 "	
6. Parting.....	0' 0⅙ "	
7. Coal.....	1' 5 "	

The coal of Nos. 1, 3 and 5 is compact, though in part of slaty structure, and is an excellent fuel. The ash is bulky but powdery. No. 7 breaks much like cannel, and in appearance is fully equal to some of the Pennsylvania cannels which are thought to be good marketable coals. It gives a long quick flame, and yields a bulky, powdery ash. This bench is sometimes parted near the middle. The lower division of the bed is not well exposed, but as nearly as can be determined, its thickness is 30 inches near the mouth of this pit.

An opening near the mouth of Willow creek cañon showed :

1. Coal.....	0' 11 "	} 3' 7½''
2. Parting.....	—	
3. Coal.....	0' 10 "	
4. Parting.....	—	
5. Coal.....	0' 7½''	
6. Parting.....	—	
7. Coal.....	0' 6 "	
8. Parting.....	—	
9. Coal.....	0' 9 "	

This also is on the upper division, and the features are very similar to those observed at the Fulbrite opening. At the time of examination, the entry had been driven 79 feet, but sound coal had not been reached as the hillside is very badly slipped. Another opening was run at a little distance further up the cañon. There the lower division is insignificant, and an entry had been driven nearly 60 feet in the upper division, which showed :

1. <i>Coal</i>	0' 6'' to 8''	} 2' 11'' to 3' 7''
2. Sandstone parting.....	0' 1'' to 2''	
3. <i>Coal</i>	0' 7''	
4. Clay and sandstone.....	0' 1'' to 2''	
5. <i>Coal</i>	0' 8''	
6. Bony coal.....	0' 2'' to 3''	
7. <i>Coal</i>	0' 5''	
8. Bony coal.....	0' 1'' to 2''	
9. <i>Coal</i>	0' 4'' to 6''	

The quality of the coal varies materially in the several benches. It all burns readily, and yields a powdery ash. No. 7 and 9 are liked for use as domestic fuel. At another opening further up the cañon, the lower division is worthless, and the mining was done on the upper division, which shows :

1. <i>Coal</i>	0' 6½''	} 2' 11½''
2. Parting.....	—	
3. <i>Coal</i>	0' 6''	
4. Parting.....	—	
5. <i>Coal</i>	0' 6''	
6. Parting.....	—	
7. <i>Coal</i>	0' 8''	
8. Parting.....	—	
9. <i>Coal</i>	0' 9''	

Unlike the other pits, this shows no good coal, and the whole bed is more or less bony. The last opening examined is at nearly two miles from Raton, and very near the last exposure of the bed in this cañon. No exposure of the rocks, either above or below the bed, was found, but the structure at this opening is so different from that observed at the other pits, that there is no room for doubting that this is the lower division. The section is :

1. <i>Coal</i>	0' 4½''	} 3' to 2' 10½''
2. Shale.....	0' 2½'' to 4''	
3. <i>Coal</i>	1' 3'' to 9''	
4. Shale.....	0' 5'' to 8''	
5. <i>Coal</i>	0' 9''	

No. 1 burns well, but is very bony, and the ash consists of angular frag-

ments. No. 3 leaves a powdery ash, but it is pyritous. Nos. 2 and 4 vary at its expense. No. 5 is merely a coaly shale. The roof is irregular, and rolls or horsebacks cut out much of the bed.

The coal from the *Dillon bed* is far from being such as is obtained from the standard beds of the Appalachian field, but it is fully equal to that from many beds, which is used as domestic fuel over large areas of our country. That from the openings in Dillon's cañon, from Fulbrite's opening and from one opening in Willow's creek cañon is a good domestic fuel, superior indeed to that from the *Waynesburg coal bed* in Southwest Pennsylvania, which is an important source of supply for an extensive area. The ash does not exceed 15 per cent., barely one-half more than the amount contained in much of the Connellsville coke. This bed will become important to the region along the Atchison, Topeka and Santa Fé Railroad, which is cut off from the *Trinidad bed* at Trinidad, by the difficult grade between Trinidad and Raton pass.

Another bed, probably *coal bed H* of the writer's generalized section, has been mined to some extent near the head of Willow creek cañon. The bed was opened somewhat more than a year ago by Mr. Pettigrew, who hauled the coal to Raton. The section at the Pettigrew opening is :

1. Coal.....	1' 0''	} 5' 10''.
2. Shale.....	1' 0''	
3. Coal.....	2' 2''	
4. Sandy shale	0' 1½''	
5. Coal.....	0' 10'' to 8''	
6. Sandy shale.....	0' 1''	
7. Coal.....	0' 8''	

No. 1 is slaty, and streaks of coal occur in No. 2. The coal from No. 3 is clearly the best found within several miles of Raton. It leaves a somewhat bulky ash and contains some pyrites, but it is a strong fuel, and admirable for steaming, as has been proved by tests on locomotives, where it worked better than the Trinidad coal does. It is preferred also for domestic purposes. The coal from No. 5 is but little inferior to that from No. 3, and the two benches were mined. No. 7 yields a coal which is hardly equal to that of the other two benches. The bed is somewhat twisted in this mine. A sudden dip was found at a short distance from the mouth of the pit, which continues for somewhat more than ten yards, beyond which the miners did not follow it.

The railroad company has opened an extensive mine at a little way further down the cañon. The measurements there are almost exactly the same as in the Pettigrew opening.